THE U. S. NAVAL OBSERVATORY

STAR

Volume 8, Number 1 "All the News that Fits, We Print" October, 1998

From The Superintendent:

CAPT Dennis G. Larsen

It has been several months since the last *Star* and much has happened. The command continues to perform superbly, in every aspect. We are meeting our requirements while looking ahead to the future needs. The command inspection went very well, indicating that everyone's hard work and preparation paid off. We completed a new command assessment with mostly favorable results, though less than desirable participation. Maybe this year we can take the five minutes to fill out our assessment forms and get more meaningful results to improve our working environment.

Speaking of our working environment, I appreciate everyone's flexibility and cooperation with the many renovation projects that continue to impact our work spaces, but eventually will significantly improve our working environment conditions. The majority of these renovation projects, which include buildings 52 and 56, will be completed this winter for all of us to enjoy for years to come.

I know I had a lot of fun taste testing the dessert contest delights then getting dunked time and time again at our Annual Command Picnic in August. It was a great turn-out and I want thank all of the picnic committee members and RM for their special preparation efforts.

The Partnership Council has meet several times and continues to look out for our people, especially in the light of regionalization. An open forum was held with representatives from HRO and Naval District Washington (NDW) participating. Good questions were raised and most were answered. Those that were not addressed there were later asked at the meeting with RADM Weaver, again in an open forum. Although he could not give specifics in some areas, it was because he will need to be given a chance to look at his new regionalized assets before he can make the tough decisions. I honestly think that RADM Weaver will do the best he can for all people. The Navy's budget is just now going through reviews and may require cuts next year, but neither we and he will know that for sure until well into the next fiscal year. These budget decisions may require NDW to make changes, but for now, next year's budget is sound and does not mandate any significant cuts. In terms of regionalization, we have tried to keep everyone up to date, as much as possible. There has been no change over the last couple of months. FM, SO, and the purchasing/contract personnel from RM

In This Issue:

A Note From The Editor:

This issue of the *Star* is long overdue! My apologies all around. You'll notice that this particular issue is singularly lacking in pictures. I have so many of them from so many events of the past few months that I'm planning to print them as a separate issue in the next few weeks. So keep an eye out for the *Companion Star*, soon to be delivered to a mailbox near you!

will be regionalized. All persons have been notified, as well as the unions. The final details of people and resource transfer decisions as well as establishing support agreements with NDW, PWC, NCTS, EFA, FISC, etc... are being worked out. Most of these are in the final draft stages and should be in place by 11 OCT 98 or shortly thereafter. None of us like the idea of regionalization, but we will have to make it work to the best of our abilities, or we will all be hurt by it. Close cooperation with NDW and close scrutiny of all regionalized functions will be everyone's job. The regionalized personnel will, for the most part, still be working here with us and will always be considered members of the command and welcome at our various functions or parties.

From the operational and research point of view, we have made several important inroads. High level Navy and DoD officers have been briefed on and recognized the importance of our work. None have offered money to help us meet tomorrow's challenges yet, but they also have not said "No". I am optimistic that we will be funded in the areas of Precise Time in Space, Time Transfer improvements, Space Astrometry (FAME), and maybe even in the area of automated celestial navigation to the fleet and DoD as a backup to GPS. These are all areas that we must move ahead in, in order to keep up with the fast moving technological advances in communications, navigation, precision guided weapons, and satellite intelligence. Time and Astrometry are vital to all of these areas and no one does it better than us.

Nova's premier was a superb event, thanks to the efforts of many of our people, especially our PAOs. USNO received much praise and recognition from the Vice President and from astronaut "Pete" Conrad. The Millennium working group is making good progress and preparations for the year 2000 and for the millennium, 2001. AA is planning the 150th anniversary of the Almanac Office, to be held at the British Embassy this spring.

In addition, reorganizations and new hires are allowing us to expand and improve our operations and research in several departments. I am very pleased with these new efforts and expect great things in the near future. As a command, we are not standing still. We are looking ahead, and we must continue to do so . I am sure that I have missed several important areas on the operational side, but I don't want to take up too much space. FM, SO, and RM are also making great progress and improving their departments, in spite of regionalization. They are all working very hard, especially with year's end/closeout, HRO's slowdown, and regionalization. I want to thank everyone in the command, because you are all doing more with less at a time when we need it. Thank you and keep on moving ahead.

CAPT Larsen

REGIONALIZATION NEWS

On October 11 the Naval District of Washington (NDW) plans to implement phase I of its plan to "regionalize" all Base Operations Support (BOS) to a central management based at the Navy Yard. Several USNO Departments will be affected by this move. SO, FM, and some of RM personnel will soon answer to supervisors at the Navy Yard.

Fundamentally, though, most of these people will not physically move to the Yard, and we'll still see mostly familiar faces around USNO.

The idea behind regionalization is to save money on BOS functions. It is hoped that by streamlining these functions and delegating them out of one central location funds will be saved as the Navy's budget declines. It is hoped that regionalization, along with attrition and incentives, will result in few, if any, jobs being lost to RIF's. According to the NDW Regionalization Home Page: "It is the expressed intention of the Regional Commander that no civilian position or military billet is lost at the onset of the new Regional Command".

For more information on Regionalization, please see the NDW's Web site at:

http://www.ndw.navy.mil/html/regionalization.html

LEGACY FUNDS FOR LIBRARY

Brenda G. Corbin, Librarian

The library is the recipient of additional funds from the Department of Defense Legacy Program. The first funds were received in FY94, and additional funds were received each year through FY96. At that

point, we learned that the Legacy Program would end, but much to everyone's surprise, Congress funded a modest amount for FY98.

Two major projects which have been accomplished thus far are the online cataloging of the complete rare book collection by specialized catalogers who are authorities in the intricate rules of rare book description. Rare books are defined as those items published before 1800. Another large project was partial conservation of the rare book collection, but there were not enough funds to complete the conservation.

For the FY98 funding, the Observatory Library made a joint proposal with the Navy Dept. Library for conservation of rare books, and the online cataloging of the 19th century materials. Legacy awarded $400,000 to this joint project, with $250,000 going to the Navy Dept. Library (they had not received any earlier Legacy funds), and $150,000 to the USNO Library.

The Library hopes to complete the conservation of the rare book collection with part of this funding. The other major project is cataloging all of the 19th century materials online. When this is complete, every item in the Library's collection will be in our online catalog and the bibliographic information will be available to users worldwide.

The Library's current budget has no funds allotted for these important historical projects as all of our budget is spent on journals, current books and online services. This makes the Legacy funds very special indeed, as it allows us to place this valuable material in an online catalog so that astronomers and historians of science will have bibliographic access to these titles.

DESCENDANTS OF ASAPH HALL PRESENT USNO WITH MEMORABILIA

On May 1st, 1998, nearly 80 descendants of USNO astronomer Asaph Hall gathered in the dome of the 26-inch telescope to present the Observatory with mementos of their illustrious ancestor.

Among the memorabilia that were presented was Prof. Hall's original commission to the U.S. Navy Corps of Mathematicians, signed by President Abraham Lincoln. Also presented were the Arago Medal of the French Academie des Sciences, and the Decoration of Chevalier of the French Legion of Honor. These latter two awards join the Gold Medal of the Royal Astronomical Society, given to the Observatory in July, 1997.

Security News

Officers Levi Gray Jr, Nadell I. Scott and James W. Waters have completed 40 hours of Phase II, In-Service training (2 - 6 Feb 98). Thanks goes out to Mr. Gary Freeman of National Institue of Health (NIH) for his asking the USNO police to participate in their In-Service Training program.

Officers Leonard A. Golden Jr. and Jerry L. Whitfield are attending 40 hours of Phase II, In-Service training (23 - 27 Feb 98) currently on-going at the Washington Navy Yard. Thanks to the NDW police!

Welcome aboard to Officers Matthew J. Babcock and Robert S. Dyer. Upon completion of their 2 weeks of indoctrination training, both officers will be reassigned to the 2nd shift (1445 - 2315).

USNO POLICE EMERGENCY NUMBERS

34th Street Gate (24 Hours): 762-1468

Shift Lieutenant: 762-0336

Shift Sergeant: 762-0338

Local Emergency Number: Dial 99 + 911.

When calling the local emergency number please notify the USNO police in order to escort the emergency personnel and vehicles to the scene.

GATES (Hours of Operation):

34th Street Gate: Open 24 Hours/7 Days Per Week

South Gate: Open Monday through Friday, 0545 - 1830

Wisconsin Gate: Open Monday - Friday, 0715 - 0900 and 1530 - 1900

Davis Street Gate: Closed

Gilliss Avenue Gate: Opened as Directed, otherwise closed

Wisconsin Turnstile: 24 Hours Daily (Must have USNO Swipe Card to re-enter)

USNO IN THE NEWS

Geoff Chester, Public Affairs

It's been a very busy time over the past several months for all of us here at the Observatory, but your efforts are all paying off. We've received a huge amount of interest by the popular media, and it looks like there will be more to come.

The Millenium Committee created a Press Release on the plans to drop a time ball to mark the New Year on 1 January 2000. This release was distributed to over 1200 news organizations around the world, resulting in near-daily telephone and e-mail inquiries. As the Big Night draws near, the attention can only increase. This November a British film crew will be here to tape USNO as part of an hour-long show on the sunrise of the new millennium.

And, as many of you know, a leap-second will be inserted to UTC on 31 December of this year. The release on this event was also sent out to the same list, and an "electronic" version of the Release is available on our Web site. This event is drawing lots of attention as well.

Sean Urban and Tom Corbin wrote a feature article on the *Astrographic Catalog* which appeared in the June 1998 issue of *Sky & Telescope*. The "Around the Mall and Beyond" column in the September 1998 issue of *Smithsonian* Magazine featured the Monday Night Tour. *Scientific American* printed an article on Simon Newcomb in its October 1998 issue.

The U.S Information Agency has produced a short video on the mission of the Observatory. This will be distributed to foreign countries via USIA's satellite TV network. The video features Harold Chadsey of Time Service and Brian Mason of the Astrometry Department.

Steve Dick (History & Public Affairs) was interviewed on National Public Radio on the topic of the Search for Extra-Terrestrial Intelligence. Geoff Chester continued his monthly appearances on WMAL-AM 630 radio's "Charlie Warren Show", plugging the Observatory at every convenience.

Over the course of the next few months, look for articles in the *Washington Post* "Horizon" section, the London *Daily Mail*, and other print media. It's getting close to 2000, and we anticipate a flood of interest one 1999 gets underway.

ABSTRACTS OF RECENT PAPERS:

U.S. NAVAL OBSERVATORY: CENTER FOR RAPID SERVICE AND PREDICTIONS

J.R. Ray, J.R. Rohde, P. Kammeyer, and B.J. Luzum
Earth Orientation Dept., U.S. Naval Observatory
Washington, DC 20392 USA

[to be published in *1998 IGS Analysis Center Workshop Proceedings*, European Space Operations Centre, Darmstadt, Germany]

ABSTRACT:

The mission of the U.S. Naval Observatory (USNO) includes determining the positions and motions of the Earth, Sun, Moon, planets, stars, and other celestial objects, providing precise time, measuring the Earth's rotation, and maintaining the Master Clock for the U.S. The Earth Orientation (EO) Department contributes to this mission by collecting suitable observations and performing data analyses to determine and predict the orientation of the terrestrial reference frame within the celestial reference frame. The key parameters determined and disseminated are polar motion coordinates, Universal Time (UT1), precession, and nutation. The user community includes the U.S. Department of Defense, other U.S. government agencies, scientific researchers, and the general public. The primary applications are

for high-accuracy navigation and positioning with an emphasis on real-time uses.

In order to accomplish these objectives, USNO collaborates closely with a large number of other groups and organizations. In particular, the U.S. National Earth Orientation Service (NEOS) is a partnership with the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) primarily to organize joint VLBI (very long baseline interferometry) operations to monitor Earth orientation. NEOS serves as the VLBI coordinating center for the International Earth Rotation Service (IERS). USNO and NEOS have an enduring commitment to VLBI in order to maintain accurate knowledge of UT1, the celestial pole, and the celestial reference frame, which is realized by the positions of about 600 extragalactic radio sources. This responsibility is shared with several non-U.S. agencies which contribute essential observing time on their VLBI telescopes.

As with VLBI, the capabilities of GPS also serve important USNO mission objectives. For that reason we have participated actively with the IGS since its inception. Recently, the USNO role in the IGS has grown and further expansion is expected. This report summarizes the current status and future prospects for USNO involvement with GPS and the IGS, together with some recent results.

THE IGS/BIPM TIME TRANSFER PROJECT

J.R. Ray
Earth Orientation Dept., U.S. Naval Observatory
Washington, DC 20392 USA

[to be published in *1998 IGS Analysis Center Workshop Proceedings*, European Space Operations Centre, Darmstadt, Germany]

ABSTRACT:

The "IGS/BIPM Pilot Project to Study Accurate Time and Frequency Comparisons using GPS Phase and Code Measurements" was authorized in December 1997 jointly by the International GPS Service for Geodynamics (IGS) and the Bureau International des Poids et Mesures (BIPM). A general Call for Participation was issued shortly afterwards with responses requested by 15 March 1998. The respondents will form a working group co-chaired by C. Thomas, BIPM, and J. Ray, U.S. Naval Observatory (USNO).

A number of groups have been working for several years to develop the capability of using geodetic GPS techniques for accurate time transfer. A variety of convincing demonstrations has already been performed showing the potential for determining clock differences at the level of a few hundred picoseconds. The current state of maturity of both the global tracking network and data analysis techniques now allows practical applications to be considered. The central goal of this Pilot Project is to investigate and develop operational strategies to exploit GPS measurements for improved availability of accurate time and frequency comparisons worldwide. This will become especially significant for maintaining the international UTC timescale as a new generation of frequency standards emerges with accuracies of 10^{-15} or better.

MICROMETER MEASURES OF DOUBLE STARS

Charles E. Worley and Brian D. Mason
U.S. Naval Observatory
3450 Massachusetts Avenue, NW
Washington, DC 20392

ABSTRACT

This paper lists 844 means of 795 double stars made with the 26-inch refractor of the U.S. Naval Observatory. The 844 means are derived from 2934 measures, and each set of measures combined into a mean was obtained in the same observing season. The program has concentrated on close pairs exhibiting orbital motion. Other wide pairs are measured as time permits. These data were obtained from 17 September 1984 (1984.713) to 13 May 1990 (1990.366) and represent the last collection of visual micrometry data obtained with the 26-inch prior to the transition to a program of speckle interferometry (see Douglass et al. 1997). The measured separations range from 0\farcs10 (21572$+$1047 : Aitken 622) to 33\farcs58 (14554$+$0647 : John Herschel 1259), with a median separation of 0\farcs98.

OBSERVATION AND INTERPRETATION OF THE LEONID METEORS OVER THE LAST MILLENNIUM

Steven J. Dick

ABSTRACT:

With a possible "storm" of Leonid meteors due in November 1998 or 1999, interest in the Leonids is once again at a peak. The history of the Leonids is of particular importance, not only because they are closely associated with the origins of meteor science, but also because historical observations extending back a millennium are a substantial aid in increasing our knowledge of the Leonid meteor stream. Leonid history is thus a prime example of applied historical astronomy. In this review paper we recount the origins of meteor science with the Leonids, the discovery of the historical observations and their scientific and cultural interpretations, and the application of this information to characterize the meteor stream and to predict the strength of the 1998-1999 event. These predictions are now of more than passing interest, as meteor storms pose a potential threat to spacecraft.

A LONG PERIOD SPECTROSCOPIC BINARY IN THE O-STAR MULTIPLE SYSTEM HD 193322

W.P. McKibben, W.G. Bagnuolo, Jr., D.R. Gies, M.E. Hahula, W.I. Hartkopf, H.A. McAlister, L.C. Roberts, Jr., C.T. Bolton, A.W. Fullerton, B.D. Mason, L.R. Penny, and M.L. Thaller

For publication in the August 1998 *Proceedings of the Astronomical Society of the Pacific*

We present radial velocity measurements and a single-lined spectroscopic orbit for the bright O-type star, HD 193322 A, which we show to be a 311 d binary system that has a distant third companion (detected by speckle interferometry) in a 31 y orbit. We suggest that the speckle companion appears in the spectrum as a broad-lined component of an early B-type (and is possibly a rapidly rotating Be star). We also present a spectrum of the visual companion, HD 193322 B, which appears to be an unresolved, double-lined spectroscopic binary. Thus, HD 193322, the central object in the open cluster Collinder 419, is a multiple system of at least 5 stars (possibly 7 if the C and D components are physical). Such systems may play a key role in the dynamical ejection of runaway stars from young clusters.

DESIGN OF THE LONG DELAY LINES FOR THE NAVY PROTOTYPE OPTICAL INTERFEROMETER

James H. Clark III & Long Ha (USRA), and David Mozurkewich & J. Thomas Armstrong (NRL)

To be published in "Astronomical Interferometry", R.D. Reasenberg, ed., *Proc. SPIE, 3350* (1998)

ABSTRACT:

We have designed a method for introducing the large delays needed for the full 437 meter baseline imaging subarray of the Navy Prototype Optical Interferometer (NPOI). Long delay lines (LDLs) will introduce delay in discrete 29 meter increments for each of the six array elements. In conjunction with the 35 meters of delay from the continuously-variable fast delay lines, the LDLs will allow fringe tracking for all baselines at any position on the sky. We present the mechanical layout, alignment and vacuum design of the LDLs.

A MULTIPLICITY SURVEY OF CHROMOSPHERICALLY ACTIVE AND INACTIVE STARS

by Brian D. Mason, Todd J. Henry, William I. Hartkopf, Theo ten Brummelaar, and David R. Soderblom

Submitted to the *Astronomical Journal*

ABSTRACT:

Surveys of three samples of solar-type stars, segregated by chromospheric emission level, were made to determine their multiplicity fractions and to investigate the evolution of multiplicity with age. In total, 245 stars were searched for companions with Delta-V < 3.0 and separations 0.035" to 1.08" using optical speckle interferometry. By incorporating the visual micrometer survey for duplicity of the Lamont-Hussey Observatory the angular coverage was

extended to 5.0" with no change in the Delta-m limit. This magnitude difference allows mass ratios of 0.63 and larger to be detected throughout a search region of 2--127 AU for the stars observed. The 84 primaries observed in the chromospherically active sample are presumably part of a young population, and are found to have a multiplicity fraction of 17.9 +/- 4.6 %. The sample of 118 inactive, presumably older, primaries were selected and observed using identical methods, and are found to have a multiplicity fraction of only 8.5 +/- 2.7 %. Given the known link between chromospheric activity and age, these results tentatively imply a decreasing stellar multiplicity fraction from one to four Gyr, the approximate ages of the two samples. Finally, only 2 of the 14 very active primaries observed were found to have a companion meeting the survey detection parameters. In this case, many of the systems are either very young, or close, RS CVn type multiples that are unresolvable using the techniques employed here.

From The Editor

Geoff Chester, Public Affairs Office

Well, another long-overdue issue of the *Star* has finally hit the deck. Hopefully I'll get a handle on all the doings around here and bring out slimmer issues with more frequency. With any luck, the Star will become a bi-monthly newsletter.

It's almost impossible to keep up with all of the activities and projects that are ongoing here at USNO. For the latest on what you folks are doing, I really need to hear from you. I can report on big events, like the Hall Presentation or the NOVA party, but the really important work won't get much airplay unless you toot your horn. So please take some time to jot a few lines about a project or program that you're working on. This newsletter exists to help us all understand the various activities we all conduct.

My first year here at USNO has flown by, and now I find myself well into my second. I can tell you that it's a far cry from the tourist-ridden Smithsonian, but interest in who we are and what we do is very strong on the "outside". The public tours have been very well-attended, and more newspapers, magazines, and broadcast media are taking an interest in our activities. I will continue to encourage this attention.

Volunteers Needed for Monday Night Tours (Still!)

Geoff Chester, Public Affairs Office

As many of you know, the Observatory hosts a tour for the general public every Monday night, except on Federal holidays. This tour is the only chance that most people have to see the workings of a modern, world-class observatory, and it is very popular. This summer we have had several capacity crowds, and the fall promises to be very busy.

In the aftermath of regionalization, the Public Affairs Office needs escorts to help out on the Monday Night Public Tours. We are looking for three individuals per evening per week to help keep the tour groups together as they proceed to the tour's three stations (Building 1 Lobby, Master Clock, and either the 12- or the 26-inch telescope, depending on the weather.) 3 hours of overtime will be authorized to escorts. Scheduling will be handled by PAS. For further information contact Geoff Chester, 762-1438, grc@spica.usno.navy.mil.

It takes a good deal of effort to make these tours proceed smoothly, but most of all it takes a bit of time commitment from those few staff members who like to show off their work place.

I'd like to involve more of you in this worthwhile effort. I don't ask for much, just one evening per month would be fine. If you'd like to help out, just let me know. I'll put you to work right away!

The U.S. Naval Observatory *Star*
U.S. Naval Observatory, Washington, D.C.

Superintendent
Captain Dennis Larsen

Deputy Superintendent
Commander Mark Gunzelman

Scientific Director
Dr. Ken Johnston

Editor
Geoff Chester

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Please address all contributions to:

Editor: Geoff Chester, USNO Star, Bldg. 1, Room Q. 762-1438. FAX: 762-1489

e-mail: grc@spica.usno.navy.mil